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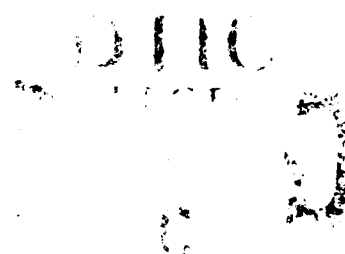
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Department of Defence

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**Visits by
Nuclear Powered Warships
to Australian Ports**

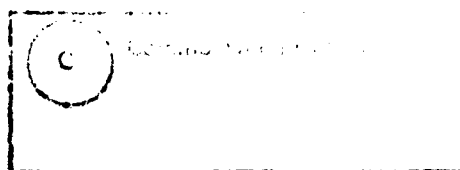
Report on Radiation Monitoring During 1990

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Canberra, Australia

June 1991

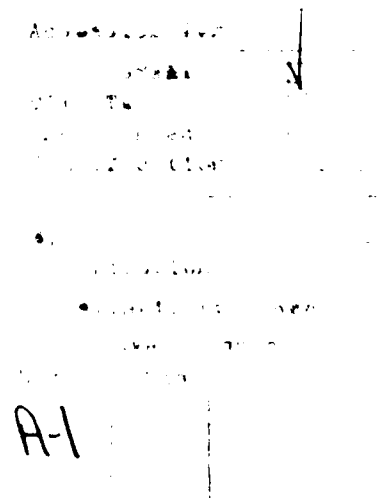
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**VISITS BY
NUCLEAR POWERED WARSHIPS
TO AUSTRALIAN PORTS**

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SUMMARY

Visits were made by two Nuclear Powered Warships of the United States Navy to Australian ports in 1990. The USS TRUXTUN visited HMAS STIRLING, Western Australia and the USS CARL VINSON visited Gage Roads, in Western Australia. The Commonwealth Government requires that a radiation monitoring program be carried out in association with such visits to detect any release of radioactivity to the port or its environs.

This report presents a summary of the objectives and requirements of the NPW radiation monitoring program, describes the implementation of the program for the visits during 1990 and records the results of radiation measurements taken in the ports visited.

No releases of radioactive material were detected, nor were any radiation measurements recorded in excess of background levels of ionising radiation, either during or subsequent to these visits.

PART 1 - GENERAL

INTRODUCTION

1. Visits were made by two Nuclear Powered Warships of the United States Navy to Australian ports in 1990. The USS TRUXTUN visited HMAS STIRLING, Western Australia and the USS CARL VINSON visited Gage Roads, in Western Australia. The Commonwealth Government requires that a radiation monitoring program be carried out in association with such visits to detect any release of radioactivity to the port or its environs or any increase in external radiation levels above that due to natural background.

2. This report presents a summary of the objectives and requirements of the NPW radiation monitoring program, describes the implementation of the program for the visits during 1990 and records the results of radiation measurements taken.

THE RADIATION MONITORING PROGRAM

3. The requirements for the monitoring program are laid down in **Environmental Radiation Monitoring During Visits of Nuclear Powered Warships to Australian Ports - Requirements, Arrangements and Procedures** - Department of Defence May 1988. These requirements were previously published in the **Report and Guidelines on Environmental Radiation Monitoring During Visits to Australian Ports by Nuclear Powered Warships** - Department of Science and Environment - September 1979.

4. The monitoring program has two main components:

- a. environmental monitoring, designed to detect the release of any radioactive material (eg waste) to the environment; and
- b. direct radiation monitoring, designed to provide warning of any malfunction of the reactor of an NPW while in port, which might lead to a release of radioactivity.

Environmental Monitoring

5. The environmental radiation monitoring program is intended to provide assurance that there has been no infringement of Australian public health standards due to the release of radioactive material from the waste control and retention systems of a visiting NPW.

6. The relevant Australian public health standards are those endorsed by the National Health and Medical Research Council in 1980 (**Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation**, AGPS 1981). These standards relate to permissible ionising radiation doses received by individuals from both external radiation sources and from the intake of radionuclides in air, water and foodstuffs.

7. **Internal radiation.** Internal radiation exposure of individuals could follow consumption of seafoods should these become contaminated with radioactive waste material. Accordingly, a marine environmental monitoring program is implemented to take samples of the surface layer of the bottom sediment and selected seafoods or seaweed (where available), from the vicinity of approved berths and anchorages.

8. These samples are analysed for evidence of cobalt-60 and other artificial gamma ray emitting radionuclides known to characterise the radioactive waste likely to be held in an NPW.

9. **External radiation.** When an NPW is at an alongside berth, gamma radiation surveys are undertaken at the wharf in those areas in the vicinity of the vessel designated as free for access by the public or by port employees. Surveys are made initially on the vessel's arrival and periodically thereafter for the duration of the visit, using portable meters capable of measuring ionising radiation dose rates down to 0.1 $\mu\text{Sv h}$ full scale (1 $\mu\text{Sv h}$ is 10^{-6} Sv h).

10. **Thermoluminescent dosimeters.** In order to record the accumulated ionising radiation doses that might be experienced in the port environs following an accidental release of airborne radioactivity, a number of thermoluminescent dosimeters (TLDs) are exposed at selected locations. The TLDs remain in position during the period that an NPW is in port or, in the event of an accident, would remain in position until the termination of the accident. Control TLDs are exposed at the Australian Radiation Laboratory in Melbourne and also in the port being visited, but remote from the NPW to provide a comparison with the TLDs exposed in the field. Field and control TLDs are returned to the Australian Radiation Laboratory for measurement.

Direct Radiation Monitoring

11. **Early warning detection.** In order to provide early warning of an NPW reactor malfunction at an alongside berth, fixed radiation detectors are located in the vicinity of the vessel to provide continuous monitoring of gamma radiation levels. The detectors cover the range 0.01 $\mu\text{Sv h}$ to 0.1 Sv h with an audible alarm set to trigger at a level of 1.0 $\mu\text{Sv h}$. A significant release of radioactivity within the vessel from the reactor would be detected and initiate an alarm.

PROGRAM IMPLEMENTATION

The Monitoring Program

12. The monitoring program is undertaken by groups made up from the Australian Nuclear Science and Technical Organisation (ANSTO), the Health and Environmental authorities of the host State and the Royal Australian Navy (RAN). The composition of the groups varies in different ports except that the Leader of the Radiation Monitoring Group is always a radiation protection officer of the ANSTO.

13. The marine environmental monitoring program is a joint undertaking by the Commonwealth Department of Community Services and Health and either the State concerned or, where the berth is in a naval establishment, the RAN. The collection of samples of sediment and seafood or seaweed is carried out by State authorities or by the RAN, nominally at quarterly* intervals at approved berths and anchorages. Samples are also taken prior to and immediately after each visit. The analysis and measurement of samples is undertaken by the Department of Community Services and Health at the Australian Radiation Laboratory. Details of the measurement method and detection capability are presented in Appendix 1.

14. The routine sampling program may be discontinued at NPW berths and anchorages being visited infrequently and where an adequate data base has been established. When an NPW subsequently visits such a berth, samples are taken prior to and immediately after the visit and a further set of samples 3 months later.

Contingency Arrangements

15. Port safety organisations have been established at all ports approved for NPW visits and arrangements made so that in the event of a reactor accident they would be activated immediately. Simultaneously, radiation surveys would be initiated by Commonwealth officers in order to identify any radiation hazards. Prior to each visit, the Port Safety Organisation is brought to a state of readiness and briefings conducted to familiarise key participants with the operational procedures and the tasks required of them in the event of an accident. Normally, an exercise is conducted prior to an NPW visit involving key members of the Port Safety Organisation.

* In practice, quarterly generally means 14 days either side of the end of the quarter. Should pre- or post-visit samples fall within two weeks of the due date for routine sampling, then the same set of samples will suffice for the routine and either pre- or post-visit samples. Authorities occasionally have difficulty in obtaining samples within these timescales.

PART 11 - NUCLEAR POWERED WARSHIP VISITS IN 1990

HMAS STIRLING, GARDEN ISLAND, WESTERN AUSTRALIA

1. USS TRUXTUN a nuclear powered guided missile cruiser of the US Navy visited HMAS STIRLING, Garden Island, Western Australia during the period 12-18 June 1990 berthing at the Escort Wharf.

Radiation Monitoring

2. Throughout the visit gamma radiation levels were monitored in the vicinity of the vessel using fixed radiation detectors. Operation of the detectors commenced before the vessel's arrival and continued until its departure. Measurements were displayed and recorded on equipment located in the Naval Police Gate House which is manned continuously. In addition, measurements of gamma radiation levels were taken daily using hand held dose-rate meters in areas around the vessel which were accessible to personnel on the base.

Results

3. The gamma radiation dose rates measured by both fixed and portable monitoring equipment for the NPW visit to HMAS STIRLING were in the range 0.07 to 0.20 $\mu\text{Sv h}$ indicating that there was no observable increase in the external gamma radiation level above background.

4. Thermoluminescent dosimeters (TLDs) were exposed at five nominated locations during the visit. Control TLDs were held in Perth and at the Australian Radiation Laboratory. The range of dose rate measurements from the TLDs for the visit were as follows:

	dose rate range ($\mu\text{Sv/h}$)
Field location	0.09 to 0.12
Perth controls	0.10 to 0.11
ARL controls	0.09

GAGE ROADS, FREMANTLE, WESTERN AUSTRALIA

5. USS CARL VINSON a nuclear powered aircraft carrier of the US Navy visited Fremantle, Western Australia during the period 12-18 June 1990. The vessel anchored at the approved, designated location in Gage Roads North.

Radiation Monitoring

6. Throughout the visit gamma levels were monitored continuously in the vicinity of the vessel using portable detection equipment installed in a torpedo recovery vessel manned by RAN personnel.

7. Gamma dose rate levels were measured using hand held instruments at positions on the shore line daily during the visit and TLDs were exposed at six selected locations. Control TLDs were held in Perth and at the Australian Radiation Laboratory for analysis.

Results

8. The gamma radiation dose rates measured during the visit were within the range 0.07 to 0.20 $\mu\text{Sv h}$ indicating that there was no observable increase in the external gamma radiation level above background.

9. The range of dose rate measurements from TLDs were as follows:

	dose rate range ($\mu\text{Sv/h}$)
Field location	0.09 to 0.11
Perth controls	0.10 to 0.11
ARL controls	0.09

Marine Environment Monitoring

10. Samples of mussels and bottom sediment were collected from the vicinity of the Escort Wharf at HMAS STIRLING on three occasions and from the foreshore near Gage Roads, Fremantle on three occasions during the year. Twelve samples were collected in total, all of which were returned to the Australian Radiation Laboratory. ARL certificates of analysis showed that no radionuclide was detected that would be characteristic of the radioactive waste associated with NPW operations.

Contingency Arrangements

11. The Western Australian Port Safety Scheme for the visits of nuclear powered warships to Fremantle and Cockburn Sound was revised to reflect changes recommended in the Senate report in March 1990.

12. The WA Port Safety Organisation was placed on standby for the visit and briefings held for key personnel. The State Emergency Services Headquarters at Belmont, which was designated as the Emergency Operations Centre, was manned continuously for the period of the visit.

Training

13. In May 1990 ANSTO provided training in warship monitoring techniques for eleven personnel, eight from HMAS STIRLING and three from HMAS COONAWARRA NT. HMAS STIRLING personnel were used to assist ANSTO in implementing the monitoring program.

14. Pre-visit organisation exercises were conducted at HMAS STIRLING on Tuesday 5 June and at the Western Australian State Emergency Services Headquarters at Belmont on Wednesday 6 June 1990.

CONCLUSIONS

15. The program of radiation monitoring and marine environmental sampling implemented for visiting NPWs during 1990 was consistent with the Commonwealth Government's requirements.

16. **There was no indication of any infringement of Australian public health standards. Radiation monitoring did not detect any release of radioactive material, nor did radiation measurements indicate any value in excess of background levels of ionising radiation either during or subsequent to these visits.**

MARINE ENVIRONMENTAL MONITORING

Measurement Method

1. Each sample is measured for 10,000 seconds, in a standard geometry, in a low background gamma-ray spectrometer with Ge (Li) detector. Each gamma-ray spectrum is scrutinised over the energy range of 50 to 1500 KeV for evidence of cobalt-60 and other artificial gamma-ray emitting radionuclides.

Detection Capability

2. The measurement method used has sufficient sensitivity to detect concentrations of gamma-ray emitting radionuclides in shellfish which, based upon typical intakes of shellfish, would result in no more than one percent of the annual limits for members of the public as given in the 1980 recommendations of the Australian National Health and Medical Research Council **Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation** (AGPS, 1981).

3. For surface layer of bottom sediments, the measurement methods used has sufficient sensitivity to detect artificial gamma-ray emitting radionuclides at concentrations at least as low as 40 millibecquerels per gram of sediment.